

STATE OF CALIFORNIA  
REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF DECEMBER 7, 2007

Prepared on October 31, 2007

ITEM NUMBER: 14

SUBJECT: Perchlorate Cases

DISCUSSION:

Note: *New information concerning the following sites is shown in italics.*

**Background**

Perchlorate is both a naturally occurring and man-made chemical, although it is rarely found naturally in the United States. One-third of all perchlorate used in the United States is used in California and 90% of California's perchlorate use is related to the aerospace industry. There are three major sources of perchlorate in the United States: ammonium perchlorate has been and continues to be used as an oxidizer in solid rocket propellant, sodium perchlorate is used in slurry explosives, and potassium perchlorate is used in road flares and air bag inflation systems. Wastes from the manufacture and improper disposal of perchlorate-containing chemicals are increasingly being discovered in soil and water.

**Health Effects**

Perchlorate is known to interfere with the natural function of the thyroid gland by inhibiting the uptake of iodide. Because iodide is an essential component of thyroid hormones, perchlorate disrupts how the thyroid functions. Such an effect decreases production of thyroid hormones, which are needed for prenatal and postnatal growth and development, as well as for normal body metabolism. Potassium perchlorate was used until recently to treat hyperthyroidism related to Graves disease, and is still used diagnostically to test thyroid hormone production in some clinical settings.

**Regulatory Standards**

*On March 12, 2004, the Office of Environmental Health Hazard Assessment (OEHHA) published a final public health goal of 6.0 micrograms per liter ( $\mu\text{g/L}$ ) (or parts per billion) for drinking water. On October 18, 2007, the California Department of Public Health (formerly known as California Department of Health Services) established the California drinking water maximum contaminant level (MCL) of 6.0  $\mu\text{g/L}$  for perchlorate, which is an enforceable standard.*

**Treatment Methods**

Treatment of perchlorate contamination in water is complicated because the perchlorate anion does not respond to typical water treatment techniques because of its fundamental physical and chemical nature. The perchlorate tetrahedron itself is structured such that the four oxygen atoms surround the central chlorine atom, effectively blocking reductants from directly attacking the chlorine. Although perchlorate is thermodynamically a strong oxidizing agent, it is a kinetically sluggish species, making its reduction generally very slow and rendering common reductants ineffective. It can persist in the environment for many decades under typical groundwater and surface water conditions because of its resistance to react with other available constituents.

Perchlorate treatment technologies may be generally classified into categories of destruction or removal technologies. Destructive processes include biological reduction, chemical reduction, and electrochemical reduction. Physical removal processes include anion exchange, membrane filtration (including reverse osmosis and nanofiltration), and electrodialysis, which all require subsequent disposal of removed perchlorate. The optimum treatment technology for a given perchlorate occurrence may depend on several factors, including perchlorate concentration, the presence and concentration of co-contaminants, other water quality parameters and geochemical parameters. The presence of indigenous perchlorate-reducing microbes and substances inhibitory to their activity will also influence perchlorate treatment technology effectiveness. For in-situ treatment of perchlorate contamination, variables related to the site hydrogeologic setting, such as depth to and distribution of contaminants, soil permeability, groundwater flow velocity, etc. are also additionally important.

**Whittaker Ordnance Facility, 2751 San Juan Road, Hollister, San Benito County**  
**Project Manager: Kristina Seley: 805-549-3121**

Remedial Design/Remedial Action Work Plan (Work Plan): On May 28, 2006, Central Coast Water Board staff received Whittaker's "Remedial Design/Remedial Action Work Plan" (Work Plan). The Work Plan contains the remediation strategy for perchlorate, hexavalent chromium, and volatile organic compounds (VOCs) contamination in soil and groundwater. The Work Plan includes a design description, rationale, and schedule to mitigate the soil and groundwater impacts. The Work Plan includes design of a groundwater extraction and treatment system, plans to fill hydrogeologic data gaps, plans to conduct an additional source area investigation, and plans to decommission two offsite agricultural wells.

Groundwater Extraction and Treatment System: The purpose of the proposed groundwater extraction and treatment system is to contain groundwater migrating from the site to reduce the risk of impacting off-site groundwater beneficial uses. After the on-site groundwater is extracted, Whittaker plans to treat the groundwater with a treatment system consisting of granular activated carbon for VOC removal and a bioreactor for perchlorate and hexavalent chromium remediation.

Whittaker installed seven on-site extraction wells for the groundwater extraction and treatment system. Whittaker has not completed construction of the treatment system. On December 7, 2006, the Central Coast Water Board approved the reissued General NPDES Permit for Discharges of Highly Treated Groundwater. On December 19, 2006, Central Coast Water Board staff informed Whittaker that the updated General NPDES permit requires Whittaker to sample all extraction wells for the 126 priority pollutants, and sample the San Benito River (receiving water) at the discharge location when there is surface water flow. On June 6, 2007, Whittaker informed staff that one of the priority pollutants, selenium, was detected in one of the seven groundwater extraction wells of over ten times the effluent limit. *Central Coast Water Board staff met with Whittaker's consultant on September 11, 2007 to discuss permitting options. Based on the NPDES requirements, Whittaker will have to treat for selenium or explore other permitting options before the system begins operation. Whittaker is currently evaluating an option to reinject treated water to a neighboring property pursuant to the Central Coast Water Board Waiver of Waste Discharge Requirements. Whittaker will submit a schedule to the Central Coast Water Board by November 16, 2007 for each option they are pursuing including contingency measures.*

Offsite Agricultural Wells: In the RD/RA Work Plan, Whittaker proposed decommissioning of the Riverside and Christopher agricultural wells to reduce the vertical migration of contaminants. The agricultural wells are screened across multiple deep aquifer units. Whittaker first focused on the Christopher well located approximately 200 feet west of the property boundary.

Christopher Well: The 370-foot deep Christopher well was identified as a possible vertical conduit for migration of contaminants from the Whittaker Facility. Therefore, Whittaker must abandon the well

and provide replacement water supply to the Perry Farms. Whittaker drilled a replacement well and found that the water quality does not meet agricultural supply use criteria; therefore, Whittaker cannot use the well for replacement water supply. Whittaker is currently researching other replacement water options including supply from San Benito County's irrigation supply line. On July 20, 2007 Water Board staff approved Whittaker's July 7, 2007 "Christopher Well Abandonment Work Plan", which outlines the approach for abandoning the inactive Christopher Well. *Whittaker's consultants destroyed the well on August 8, 2007, in accordance with San Benito County Water District and California Well Standards. On September 27, 2007 Whittaker submitted the Christopher Well Abandonment Report which summarized well abandonment operations including well cleaning, casing perforation, and placement of seal materials.*

Riverside Well: The Riverside well is an agricultural supply well impacted with both VOCs (430 µg/L to 600 µg/L in 2005) and perchlorate (50 µg/L to 100 µg/L in 2005). In 1993, Whittaker voluntarily equipped the well with a VOC treatment system for continued agricultural use and connected the 14 well users to City water for domestic supply. Because the well is impacted with perchlorate, and because the well may act as a vertical conduit for plume migration, Central Coast Water Board staff requested Whittaker shut down the well and properly decommission it.

Central Coast Water Board staff met with Whittaker's consultant and five of the 14 Riverside Irrigation Company members on February 15, 2007. Following the meeting, a Riverside Well Irrigation Company representative informed the Central Coast Water Board that PG&E shut down power to the Riverside well on February 23, 2007. Central Coast Water Board staff is working with the well users and Whittaker to decommission the well. *In an October 11, 2007 letter, Whittaker requested permission from the Riverside Irrigation Company members to abandon the well. Whittaker sent the request to all 14 members of the company and are waiting a response as of the date of this staff report.*

**BAE Systems (former United Defense), 900 John Smith Road, Hollister, San Benito County**  
**Project Manager: Kristina Seley 805-549-3121**

Background: BAE Systems has conducted military armor and tracked vehicle testing since 1968. The site, located on approximately 1,200 acres, contains several buildings, former munitions magazines, and two munitions test arenas. Constituents of concern identified in soil and/or groundwater include perchlorate and explosives.

Cleanup Actions: In late September 2005, BAE Systems excavated shallow perchlorate-impacted soils in Arena 1 at concentrations greater than 5 milligrams per kilogram (mg/kg). BAE Systems removed approximately 400 cubic yards of soil and installed a 35,000 square foot temporary chip seal cap at Arena 1 to minimize potential mobilization associated with rainfall and runoff infiltration.

Current Investigation: On April 25, 2007, Central Coast Water Board staff discussed Work Plan comments with BAE Systems' consultants via phone, and concurred with the Work Plan recommendations in a letter dated April 26, 2007. *BAE Systems submitted the Phase VII Report with findings and recommendations on October 31, 2007. Central Coast Water Board staff will meet with the consultants at the site during Phase VII investigative work to discuss initial findings and review BAE Systems' response to comments regarding the 2006 Human Health and Ecological Risk Assessment Report.*

**MK Ballistic Systems, 2707 Santa Ana Valley Road, Hollister, San Benito County**  
**Project Manager: Kristina Seley 805-549-3121**

Background: The MK Ballistic Systems site is located west of the BAE Systems Test Facility property. Currently, MK Ballistic Systems leases buildings and storage magazines on the five-acre

property and manufactures "less-lethal" explosives and ordnance components and devices. Numerous other tenants have conducted similar operations at the facility and have used perchlorate and other explosive compounds in their manufacturing processes. In 1991, U.S. EPA conducted a time-critical cleanup action when one of the former tenants, Caelus Devices, Inc., went bankrupt and abandoned the facility without proper containment and storage of shock-sensitive explosive chemicals.

Concern: BAE Systems tested all its site wells for chemicals of concern. Perchlorate was detected for three consecutive quarters at about 30 ppb in a windmill well upgradient from all identified soil and groundwater perchlorate impacts. BAE Systems' *Phase IV Environmental Investigation Report* proposed that historical use of perchlorate at the neighboring site, MK Ballistic Systems, may be the cause of contamination. Based on the historical use of perchlorate and explosives at MK Ballistic Systems, and due to the perchlorate detections in the windmill well, staff believe that current or past practices at the MK Ballistics site may have impacted groundwater.

Action: On April 14, 2006, staff received the "MK Ballistic Systems Site Environmental Investigation Work Plan." The work plan summarized historical site operations and proposed a perchlorate soil and groundwater investigation. Central Coast Water Board staff generally concurred with the work plan, and provided comments in a June 23, 2006 letter. MK Ballistic Systems' landowner and lessee are required to submit a summary of their findings and an interpretation of the data in an Environmental Investigation Report.

Central Coast Water Board staff was contacted by the Department of Toxic Substances Control (DTSC) regarding this site. DTSC was investigating the storage and handling of hazardous waste and explosives contained at the site. On February 15, 2007, Central Coast Water Board staff met with DTSC staff and the land owner's representatives in Hollister, CA. DTSC staff provided a copy of the soil sampling results that they conducted as part of their investigation.

In a May 23, 2007 correspondence, the Central Coast Water Board staff directed the responsible party to submit a work plan addendum by June 22, 2007. The directive requires metal analysis in soil at locations DTSC detected elevated surface contamination during their December 2005 site investigation. During July 2007, the consultant obtained additional environmental reports that include information on materials stored, removed, and demolished at the site. *In August 2007, the consultant requested a time extension in order to review the new data and optimize the soil and groundwater sampling locations, and to determine if there are additional constituents that should be considered. Central Coast Water Board staff agree with the consultant's approach and approved an extension. Central Coast Water Board staff will receive the Work Plan prior to the December Water Board meeting. The consultant anticipates completing groundwater and soil sampling, upon work plan approval, by March 2008.*

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